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ABSTRACT

This study examined elementary teachers' perceptions about their preparation for efficient, effective implementation of technology, the adaptability of technology to teaching style, and the effect on students of their technology use, investigating whether there was a correlation between those three variables. This work also examined the effects of the grade level in which the teacher taught on all three variables. Data came from a survey given to elementary teachers in a school that had recently introduced technology-based learning into a traditional school setting. The survey included 47 questions with a four-point response scale. The data were analyzed using descriptive statistics, correlation analysis, and one-way analysis of variance. Results indicated that teachers felt strongly that they had been efficiently and effectively prepared for implementing technology, that technology was adaptable to their teaching styles, and that the use of technology positively affected students. There was a positive correlation between the variables "preparation for technology" and "effect on students" and "preparation for technology" and "adaptability of technology to teaching style." Teachers were still at the developmental stage in implementation. The grade level in which teachers taught had no effect on the three variables. (Contains 4 tables and 19 references.) (Author/SM)

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TECHNOLOGICAL INNOVATION: TEACHER PREPARATION, ADAPTABILITY, AND EFFECTIVENESS

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Abstract

The study examined the perceptions of teachers as to their preparation for the efficient and effective implementation of technology, the adaptability of technology to teaching style, and the effect on the students of their use of technology. It attempted to determine if there was a correlation between preparation for implementation, adaptability of technology to teaching styles, and the effect on the students of their use of technology. In addition, the study looked at the effects of the division in which the teacher taught on all three variables.

Data for the study were obtained from a survey given to elementary teachers in a school that had recently introduced technology-based learning into a traditional school setting. The data were analyzed using descriptive statistics, correlation analysis, and a one way analysis of variance.

The results showed that the teachers felt strongly: that they had been efficiently and effectively prepared for the implementation of technology; that technology was adaptable to their teaching styles; and that the use of technology had a positive effect on the students. Moreover, the results showed that there was a positive correlation between the variables preparation for technology and the effect on students and preparation for technology and the adaptability of technology to teaching style. Finally, the results showed that the division in which the teacher taught had no effect on the three variables.

Introduction

The expansion of technology permeates all aspects of our society today. Educators realize that technologically advanced education is not only here to stay, but that teachers are primarily responsible for preparing students to meet the challenges in a technological workplace. Teachers must first feel comfortable with technology. It is incumbent upon teachers to realize that technology will not replace them, but that their roles need to be redefined. In order to understand the key to success in the implementation of technology, one must look at the evolution of the implementation process, the necessary ingredients for getting it off to a successful start and what is needed to keep the process growing and maturing.

In 1991, the study school was converted from a school which offered a traditional program to a school with technology integrated from Junior Kindergarten to Grade 8. At that time the staff of the school was comprised of many veteran teachers. The teachers on staff were given the option to stay if they were accepting of the change. Those who were not accepting of the change were replaced by staff members from other schools who wished the opportunity to become involved in a technology-based school.

The present study seeks to ascertain whether or not teachers felt they were adequately prepared to make the change to teach effectively in the new environment. A second research question is used to investigate whether or not the

change has affected their teaching style. The study also seeks to determine if there is any advice that can be derived from this study to facilitate similar changes in other schools converting to a new technology base.

Literature Review

Most teachers rely on textbooks and lecturing as their main teaching tools. Technological advancements such as television, films, and programmed learning materials are available but are not used on a consistent basis. Even in the early 80's, it was acknowledged that one of the keys to persuading teachers to use technology was an extensive program of in-service and professional development. Lidtke (1981) said that acceptance of technology only occurs when the teacher feels that the technology is effective with students. A second finding of the Lidtke study was that teachers needed adequate training to effectively and efficiently use the technology and that the technology had to fit the teaching style of the teacher.

Gjelton (1985) reported the results of a study completed in a small rural area in California which had, in a span of five years, fully implemented computers into its program. The principal, who had been the initiator and champion of the change, retired from the board. Levin (1984) pointed out that the teachers in the school were sufficiently convinced about the merits of using computers. She cautioned that this might not be enough to ensure successful implementation since the replacement principal had no computer background and no interest in learning about computers. The teachers were the key to the success of the project, but it

was questionable whether or not this project could be generalized for other rural schools because of the unique combination of people it involved.

Olson and Eaton (1986) presented case studies of microcomputers in the classroom in Toronto. Research on technology evolved from looking only at change to looking at the teacher and program delivery. Olson and Eaton found that teachers had integrated computers into familiar teaching routines. Because of their concern to cover the traditional curriculum in an effective way, teachers did not risk any radically different methods in teaching styles.

Teachers who have already adopted a style that was consistent with incorporating reforms found computers to be a support. Most teachers made developmental changes - teaching with the same goals but using different methods or materials; some made transitional changes - setting new goals and implementing activities to teach them; and even fewer made transformational changes - systemic or structural changes (LaFrenz & Friedman, 1989).

Stearns (1991) contended that if faculty members were given access to technologies, knowledge of how to use them, and the power to use and develop their own tools to meet instructional objectives, the results would be school-wide integration of technology into the curriculum. Teachers' perceptions of whether or not they have been adequately prepared for the technology have much to do with whether or not they at least reach the developmental stage of computer use; that is, teaching with the same goals but using different methods or materials. Teachers only move on to make transitional and then transformational changes if

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they can see that their implementation of technology is having a positive effect on their students. Teachers who received what they considered to be good training and on-going professional development support, and who perceived that technology had a positive effect on their students, were likely to continue to integrate technology into their programs (Spina, 1988; Kell, 1990).

Statement of Research Questions

The following research questions were developed from previous study:

1. Do the teachers at the study school perceive that they are adequately trained to efficiently and effectively use technology in the school?
2. Are the teachers satisfied that the technology fits their style of teaching ?
3. Do the teachers of the study school feel that the use of technology has a positive effect on their students?
4. Is there any correlation between preparation for implementation of technology, the adaptability of technology to teaching style, and the perceived effect of technology on the students?
5. Does the division (primary, junior, intermediate) in which the teacher teaches have an effect on the preparation for efficient and effective implementation of technology, on the adaptability of technology to teaching style, and on the perceived effect of the use of technology by students?

This study was conducted in conjunction with a research project sanctioned by the Ministry of Education. The study school was a traditional school that has been converted to a technology-based school under the supervision of the Ministry of Education. The school was located in Southwestern Ontario. The project was a quantitative study which consisted of one survey which was completed over a period of three days.

Definition of Terms

For the purposes of this research, technology included: computers; laser disks; videography; lego; robotics; and hands-on materials such as techno and temsi. Teachers were defined as all classroom teachers from Junior Kindergarten to Grade Eight, Special Education teachers, and French language teachers.

Type of Instrument

The instrument contained a forty-seven item questionnaire with a four--point response scale. A four-point scale was used to force teachers with low intensity opinions to express that opinion, either positively or negatively. The questionnaire was divided into three main parts: preparation for technology; effect on teaching styles; and effect on students. Each item completed a sentence which began with "I think..." and this phrase must be inserted at the beginning of each item. The teachers responded using a four point scale: strongly agree, agree, disagree, strongly disagree.

The study included 20 regular classroom teachers from Junior Kindergarten to Grade 8, 3 French teachers who covered all the grades

mentioned, and 3 Special Education Teachers. Twenty-five out of 26 staff members responded. Prior to the collection of data, permission was obtained from the Ministry of Education, the School Board, and the Principal. The questionnaires were distributed and collected three days following their distribution.

Variables

Four input variables were retained in this study. One was the teacher and the other three were preparation for the implementation of technology, adaptability of technology to teaching style, and the perceived effect of technology on students.

The output variables were attitudinal: the first being the teacher's perception as to whether or not he or she was adequately prepared for technology; the second being whether or not the teacher felt that technology was adaptable to his or her teaching style; and the third being whether or not the teacher perceives that technology has a positive effect on the students.

Statistical Treatment

Descriptive statistics were used to determine if teachers felt adequately prepared for technology, if technology was adaptable their teaching style and if technology had a positive effect on the students. Mean scores were calculated for each part of the survey as well as the overall survey. Standard deviations were used to verify whether or not the scores overlapped between positive and negative responses. A mean score of less than 2.5 indicated support for the hypotheses

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since there was no allowance for an inapplicable or no opinion score on the survey.

To determine if there was a correlation among the three variables, preparation for effective and efficient implementation of technology, adaptability of technology to teaching style, and the perceived effect of technology on the students, the Pearson product-moment correlation coefficient was used.

A one-way analysis of variance (ANOVA) was used to determine if the division in which the teacher teaches had any effect on the preparation for technology, the adaptability of technology to teaching style, and the effect of technology on the students. F-scores were used and if the probabilities were 0.05 or less, the results were considered significant.

Analysis of Data

Analysis of the data is presented according to the five questions under investigation in the study. Data analysis was conducted using Statistical Package for Social Sciences (SPSS/PC+). The program allows researchers to complete analysis of data from descriptive statistics to multiple-regression techniques.

Three types of analyses were chosen - descriptive statistics to analyze survey results in relation to questions 1, 2, and 3 of the study; a correlation analysis to address question 4 of the study; and a one-way analysis of variance (ANOVA) to analyze the survey results in relation to question 5 of the study.

The survey was designed such that a low score response (1 or 2) indicated agreement with the survey statement while a high score response (3 or 4)

indicated disagreement with the survey statement. All items on the survey were presented in the positive. Any score less than 2.5 indicated agreement with the statement made while a score in excess of 2.5 indicated disagreement with the statement made. The mean scores from Part A, Part B, and Part C of the survey were calculated for each teacher and an overall mean score was tabulated for the entire group.

The first question in the study explored whether or not the teachers felt adequately prepared for technology. The first hypothesis stated that teachers felt they had been adequately trained to efficiently and effectively use the technology in the school. Part A of the survey contained 15 items that addressed the question. No attempt was made to differentiate the reasons for a positive or negative attitude based on the types of questions contained in Part A. Therefore, it was sufficient to consider only the mean scores fof each teacher for Part A, and then calculate the overall mean score of the 25 teachers for Part A.

Table 4.1 outlines the mean score, standard deviation (Std Dev), minimum score (Min), maximum score (Max), and the number of teachers in the survey (N Obs) for Part A of the survey.

Table 4. 1

Descriptive Statistics for Variables Used in the Survey

Variable	Mean	Std. Dev	Min	Max	Obs
Preparation	1.94	.32	1.1	2.5	25
Style	1.76	.36	1.1	2.3	25
Effect	1.64	.39	1.1	2.6	25

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The overall mean score of 1.94 for the population of 25 teachers indicated strong positive agreement that the teachers felt they were adequately prepared for technology. If one considers one standard deviation, the variance of scores from 1.62 to 2.26 suggested that approximately 68 % of the teachers were well within the boundary of 2.5 for agreement with preparation for technology. Thus it can be stated that teachers felt adequately trained to efficiently and effectively use the technology in the school.

The second question posed was whether or not the technology fits the teaching style of the teacher. Part B of the survey contained 12 items which dealt with technology and teaching styles. Mean scores were calculated and then an overall mean for the population of 25 teachers was determined for Part B. The results were summarized in Table 4.1 in the same form as for Part A of the survey. The overall mean score of 1.76 for the population of 25 teachers indicated a strong positive agreement that teachers felt technology fits their teaching style. The variance of scores within one standard deviation of the mean ranged from 1.40 to 2.12 and indicated that approximately 68 % of the teachers were within the limit of 2.5 for agreement that technology fits their teaching style.

The third question posed was whether or not the teachers felt that the use of technology had a positive effect on their students. Part C of the survey consisted of 16 items which addressed the question. Mean scores for each teacher were calculated as was an overall mean for the 25 teachers for Part C. The results are summarized in Table 4.1 in the same form as for Part A and B. An overall

mean score of 1.645 indicated strong agreement that the teachers felt that technology had a positive effect on the students. The variance of scoreswithin one standard deviation from 1.35 to 2.03 suggested that approximately 68 % of the teachers were within the boundary of 2.5 for agreement that technology has had a positive effect on the students.

The fourth question posed was whether or not there was a relationship between the three input variables: preparation for effective and efficient implementation of technology, adaptability to teaching style, and effect on students. The Pearson product-moment coefficient was used to investigate this question. The results are summarized in Table 4.2.

Table 4.2
Correlations for Variables in Study

	PREPARATION	STYLE	EFFECT
PREPARATION	1.0000	.6869	.4433
STYLE	.6869	1.0000	.4760
EFFECT	.4433	.4760	1.0000

The use of the Pearson product-moment coefficient provided two things: a measure of strength of this relationship and an indication of the direction of that strength. Since the Pearson coefficient of 0.6869 for the first two variables was positive, it indicated that there was a positive relationship between the first two variables, preparation and style. In terms of strength, the closer the numerical value of the coefficient to one, the greater the correlation between the variables. Thus, there was a strong correlation between preparation and style. The second pair of variables was preparation and the effect on the students. The correlation

coefficient was 0.4433 as indicated in Table 4.2.. Because it was a positive result, it indicated a positive relationship between preparation and the effect on the students, but because it was not above 0.5000, it could be considered a strong correlation. The third pair of variables considered were style and the effect on the students. The result, as shown in Table 4.2, was a correlation coefficient of 0.4760. This also indicated a positive, but weak, correlation. As indicated by the Pearson product-moment correlation coefficient results, the three variables were positively correlated.

The fifth question posed was whether or not teachers in different divisions varied in their responses on preparation for technology, adaptability of technology to teaching style, and the effect on the students. In the survey, the breakdown of the number of teachers by division is given in Table 4.3.

Table 4.3

Number of Teachers by Division

Primary (Jr. K.P. to Gr. 3)	10
Junior (4 to 6)	5
Intermediate (7 and 8)	4

A one-way analysis of variance was used to investigate the relationships among the three populations (primary, junior, and intermediate divisions). An F distribution was used because the mean scores were divided into categories (divisions) and then compared with one another.

The F-score for preparation for technology by division was 0.7607, the F-

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score for adaptability of teaching style by division is 0.9162, and the F-score for effect on students by division is 0.4249. In each case, at the 0.05 confidence level, the F-scores indicated that there was no significant variance on the results due to division. These scores indicated that the division in which a teacher taught had no effect on the efficient and effective preparation for the implementation for technology, on the adaptability of technology to teaching style, and to the effect of technology on the students.

Discussion and Conclusions

The results of the analysis of the survey showed that the teachers at the study school were satisfied with the preparation they received to implement technology in their school. In addition, they agreed that the technology was adaptable to their teaching style, and most importantly that the implementation of technology had a positive effect on the students.

Teachers felt that technology was adaptable to teaching style, but the results indicated that the teachers were still at the developmental stage in implementation. They were teaching with the same goals but using different methods. This finding was consistent with LaFrenz and Friedman (1985). They had all passed the awareness and preparation stage and the positive results, in respect to the positive effect technology was having on the students. This seemed to indicate that most teachers had even passed through the stage of smooth and mechanical use of the technology.

The teachers acknowledged that the use of technology had a very positive

effect on their students. This was a good reason for having implemented technology. Ongoing professional development and in-service to support the changes already made and to encourage further changes seems to be indicated from this study . These findings were consistent with previous studies (Kell, 1990; LaFrenz & Friedman, 1989; Lidtke, 1981; Sarason, 1982).

The teachers at the study school have successfully implemented technology-based learning in their school thus far. Their choice to remain in the school signified a concerted, collegial effort to develop a new vision because they chose to be there. In addition to their principal who showed true commitment to the change, they have joined with a petroleum company (a business partner). The school board has shown its commitment by allowing the principal full school-based management including flexible destination of professional development time. The staff was given many opportunities to meet by division or in a large group to share their successes and failures and their input for professional development. It is clear that the teachers at this school were well on their way to making transformational changes.

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